UDK: 338.46:008(497.11); 331.102.312:004; 005.591.6
Originalni naučni rad

IT SOFTWARE INNOVATION ECOSYSTEM FOR CCIs DEVELOPMENT – THE CASE OF SERBIA

***Boris Jevtić*[1]**
Faculty of Computing
Union University, Belgrade, Serbia

***Milan Beslać*[2]**
Faculty of Business Economics and Entrepreneurship
University Privredna akademija, Belgrade, Serbia

***Dragan Janjušić*[3]**
Faculty of Management
University "Union – Nikola Tesla", Belgrade, Serbia

***Milan Jevtić*[4]**
Friedrich Ebert Foundation
Belgrade, Serbia

Abstract. *Through their innovations, the IT and software sectors are part of new emerging technologies which are fundamentally changing other cultural and creative industries (CCIs). As countries must catch up with them to develop*

[1] boris.jevtic@digit-star.com; [2] beslac011@gmail.com; [3] dragan.janjusic@gmail.com; [4] jevtic87@gmail.com.

their creative economies, the authors of this paper have performed empirical research on the national software innovation ecosystem, which included 242 IT companies from Serbia in 2022. Regression analysis and the Likert scale were used to assess the influence of three groups of factors of the e-innovation ecosystem: institutional, business, and internal factors. The key results of the research show the impact of all these factors, the most significant being that of institutional factors and public policies and measures. The results of this paper could contribute to the design of innovation-based policies, supporting an environment that would promote the creative IT economy in Serbia.

***Keywords**: creative and cultural industries (CCIs), IT software, innovation, supportive ecosystem*

INTRODUCTION

Cultural and creative industries (CCIs) include IT and software industries. The use of industry 4.0 technologies, such as artificial intelligence, 3D printing, cloud digital technologies, blockchain and drones has created new opportunities for manufacturers and providers of creative economy goods and services (UNCTAD 2022; Jevtić *et al.* 2013; Falk 2011).

Creating an environment supportive for IT CCIs private sector businesses involves policy dimensions and an environment conducive to the provision of programs favorable for fostering their R&D activities in favor of innovations, government and public institution support to have better access to R&D capital, appropriate competition and intellectual property policies and protection (Spennemann 2019; UNCTAD 2022a).

Overcoming the barriers of the software innovation support infrastructure to digitization is crucial for all creative sectors. As digital technologies are paramount for accessing markets, connectivity alone is not sufficient: digital financial services, postal services, and transport networks and infrastructure services to encourage online shopping are also required (WTO 2020).

THE IMPORTANCE OF IT SOFTWARE AS A CCIs

Data from the Creative Economy Outlook (UNCTAD 2022; Eurostat 2021) for the last ten years show that the annual growth of software services measured 5.6 percent, making up around 40 percent of total creative service exports in 2020, with the estimation that 65 percent of the world's GDP will be digitized by 2022.

	Developed economies							Developing economies	
Software				70				21	
0	50	100	150	200	250	300	350	400	450

Table 1. IT software exports, 2020
(source: UNCTAD 2022)

In Serbia, the IT sector with software services as CCIs has been growing very quickly since 2014, and there has been a permanent increase in employment, exports, and the total CCIs GVA.

	2014	2015	2016	2017
GVA (RSD bn)	30.2	31.6	60.5	98.2
As a % of total CCI GVA	36.7%	35.7%	50.7%	62.75%

Table 2. Distribution of GVA in Serbia by IT and software services
(source: authors, based on SORS5 2020)

Creative employment in IT and software industries is on the rise, over 35 percent in 2017 (SORS 2017).

	2014	2017
No of persons	18,944	24,567
% of total	31.28	35.52
Total CCIs	60,557	69,168

Table 3. Employment distribution by IT,
software as a CCIs group, 2014, 2017
(source: authors, based on SORS 2017)

Information technologies, computing and software services are classified as a division of creative industries (World Bank 2017), in the Serbian classification (Mad Marx; „Službeni list SRJ" 31/96), Information and communication activities (J5-62, and J6-63) include all activities of computing, programming, consulting, and activities related to this sector, as well as information services. According to the broader definition, they include Computer consultancy, programming, hosting, data processing, and related activities, Other information technology and computer service activities, Publishing of computer games, software publishing, Web portals, Other telecommunications activities, Retail sale of computers, software in specialized stores, and Repair of computers and peripheral equipment.

METHODS AND MATERIALS

Sampling

This part of the paper presents the results of the empirical research on the attitudes of companies from the IT sector in Serbia as a creative industry, at the level of influence of external factors of the ecosystem supporting their innovations in software development (Savić, Grozdanić 2008; Jevtić *et al.* 2020; Jevtić *et al.* 2020a; Jevtić *et al.* 2014; Mikić 2019).

The research was conducted in Serbia in 2022 using the online survey method and regression analysis. A total of 242 companies were included, of which 49.58% are software companies, 42.14% IT services, 6.61% hardware and software manufacturing, and 1.65% belong to the electronic entertainment industry. The majority of surveyed companies in Serbia belongs to small and medium-sized enterprises owned by a single founder, established as private companies, which employ from 11 to 250 people and generate revenues of up to one million euros per year (Table 3).

Variables	Frequency	Percentage
Legal form	242	100.00
Private company, single owner	83	34.29
Part of a foreign corporation	65	26.85
Private company, multiple owners	59	24,38
Entrepreneur	35	14.46
Function of the respondent	242	100.00
Owner	102	42.14
Manager	53	21.90
Director	49	20.24
ICT Specialist	38	15.70
Main activity of the company	242	100.00
Software industries	120	49.58
IT services	102	42.14
Manufacturing of hardware and software	16	6.61
Electronic entertainment industry	4	1.65
Number of employees	242	100.00
Less than 10	30	12.39
11 to 49	77	31.81
50 to 250	79	32.64
Over 250	56	23.14
Revenues	242	100.00
Less than 100,000 euros	33	13.63
100,001 to 500,000 euros	54	22.31
500,001 to 1,000,000 euros	140	57.85
Over 1,000,000 euros	15	6.19

Table 4. Sample description
(source: authors)

The theoretical model consists of two independent variables – institutional and business external factors of the ecosystem – and one dependent variable, internal factors of a software innovation ecosystem (Figure 1).

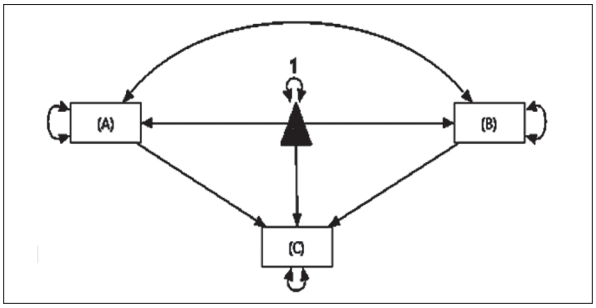

Figure 1. Research model
(source: authors)

The impact of the independent variables on the dependent variable was assessed by company representatives by expressing the level of agreement with the given statements for each variable. For those statements, a five-level Likert scale was used (in the range of 1–5, where 5 is the highest grade – "I agree completely"; 4 – "agree partly"; 3 – "neither agree nor disagree"; 2 – "disagree"; 1 – "I do not agree at all") (Table 4).

Independent variables, external innovation ecosystem factors	Statements
A. Institutional factors of the external innovation ecosystem	A_1. Universities
	A_2. Scientific organizations and institutes
	A_3. Innovation Fund
	A_4. Development Fund
B. Institutional factors of the external innovation ecosystem	B_1. Other enterprises
	B_2. Stakeholders, suppliers, clients
	B_3. Business incubators, scientific parks
	B_4. Financial, insurance organizations, banks
	B_5 International organizations, funds, donations
Dependent variable, Internal innovation factors	
C. Internal innovation factors of the company ecosystem	C_1. Research and development capacities
	C_2. Human resources capabilities
	C_3. Financial resources

Table 5. Variables in the theoretical model
(source: authors)

Based on the theoretical research model, the following hypotheses were set:

– Hypothesis H_{01}: Level A does not affect level C. Alternative hypothesis: H_{alt1}: Level A affects level C;
– Hypothesis: H_{02}: Level B does not affect level C. Alternative hypothesis: H_{alt2}: Level B affects level C;
– Hypothesis: H_0: Levels A and B do not affect level C. Alternative hypothesis: H_{alt}: Levels A and B affect level C.

Correlation analysis

Based on the research model, for single linear dependencies, statistical significance ratings of the partial effects of independent variables (A and B) on the dependent variable C were given. Table 6 provides interpretations for linear regression equations, coefficients of determination, analysis of variances, and correlation coefficients.

Independent variables	Regression equations	RSquare (%)	ANOVA	Correlation
A	C=1.8666157+ 0.5291442·A	60.91	[F(1,240)=374.0741, p<0.0001]	0.780492
B	C=2.873143 +0.2729334·B	13.20	[F(1,240)=36.4978, p<0.0001]	0.363318

Table 6. Regression analyses (source: authors)

Based on the obtained data, variable C can be explained through variable A with 60.9%, and through variable B with 13.2%. The correlation between variables A and C is strongly positive and amounts to 0.780492, while the correlation between variables B and C is relatively weak/positive and amounts to 0.363318. As variable A rises, so does variable C, and as variable B rises, variable C becomes relatively weak. The alternative hypotheses were confirmed, namely:

– H_{alt1}: Level A affects level C;
– H_{alt2} Level B affects level C.

Figure 2 shows interpretations for linear regression equations, coefficients of determination, analysis of variances, and correlation coefficients.

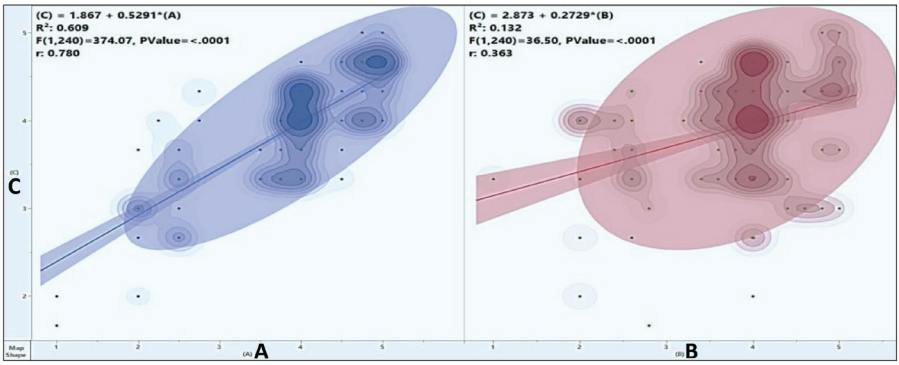

Figure 2. Regression equations for variables A & C, B & C (source: authors)

Key findings

For multiple linear dependence, interpretations of the impact of independent variables A and B on dependent variable C are given (multiple linear regression equation, multiple coefficients of determination, variance analysis, and multiple correlation coefficient) in Table 7.

Independent variables	Regression equations	RSquare (%)	ANOVA	Correlation
A & B	$C = 0.4698018+0.559705 \cdot A +0.3355275 \cdot B$	80.66	[F(2,239)=498.4667, p<0.0001]	0.898122

Table 7. Multiple correlation analysis (source: authors)

Based on the obtained research results, it is evident that the dependent variable C can be explained with 80.66% through the independent variables A and B. The correlation between variables A and B according to variable C is 0.898122 and is strongly positive. The arrangement of the impact of independent variables by importance according to dependent

variable C indicates that variable A is 0.82557 and has greater impact, while variable B is 0.446641 and has lower impact. As variables A and B increase, so does variable C.

The alternative hypothesis was confirmed: H_{alt}: Levels A and B affect level C.

The multiple linear regression resulting from the previously explained analysis (T.6) is given in Figure 3.

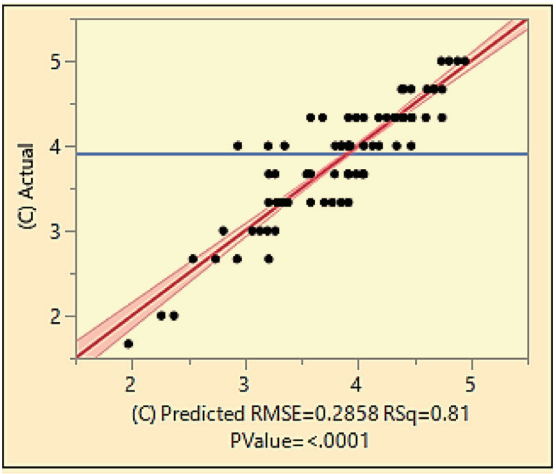

Figure 3. A plot of multiple regression equations for variables A & B and C (source: authors)

CONCLUSION

The results of the research on the innovation ecosystem for IT software as a CCIs have shown that this is a very important area of impact. The considerable impact of public policies and institutions, cooperation with universities, institutes, institutions for intellectual property rights, and national innovation funds for innovation can be seen.

Further, the impact on business partners and cooperation with other stakeholders is not as great but is still important for innovation. It is evident that there is room for improvement in this ecosystem in Serbia, and that there is a need to incorporate more appropriate modern tools

in the policies. In addition to that general conclusion, it is necessary to strengthen the institutional capacities of public and private educational and research institutions, intellectual property organizations, institutes, and government agencies responsible for promoting innovation, as well as business partners in engaged software innovation.

Digital technologies are paramount for accessing markets for crafts sectors in less developed areas.

Creating an IT innovation ecosystem conducive to creative industries may involve other policy areas for competitive markets in the creative economy in Serbia.

BIBLIOGRAPHY

Literature

Falk, R. 2011. *Innovation and competitiveness of the creative industries*. Wien: WIFO Studies: Austrian Institute for Economic Research.

Jevtić, B., Deđanski, S., Beslać, M., Grozdanić, R., Papić, Ž. 2013. "The Impact of Skilled Workers in Implementing ICT on Firm Performance". *Metalurgia International* 18(4): 152–160.

Jevtić, B., Grozdanić, R. 2014. "Strategic importance of open innovation for SMEs", 88–121. In: *Proceedings of International Scientific Conference EEE 2014: "Economic Growth and sustainable development challenges"*. Belgrade: Faculty of Business Economics and Entrepreneurship.

Jevtić, B., Kvrgić, G., Ćorić, G., Beslać, M. 2020. "Challenges of ICT Skills of SME Employees". *Limes plus: Časopis za društvene nauke i humanistiku* 1/2020: 121–142.

Jevtić, B., Zakić, N., Popović, J., Ćorić, G., Kvrgić, G. 2020a. "Digital Challenges for SMEs Organisations in Human Capital Investments and Change", 20–29. In: Da Silva, A. L., Rados, T., Kaurova, O. V. (eds) *Economic and Social Development 62nd International Scientific Conference on Economic and Social Development*. Lisbon. https://www.esd-conference.com/upload/book_of_proceedings/Book_of_Proceedings_esdLisbon2020_Online.pdf (assessed: 16. 9. 2022).

Mikić, H. 2019. „Cultural industries and the diversity of cultural expression: International institutional framework and the current conditions in Serbia". *Interkulturalnost* 6. 60–87.

Savić, B., Grozdanić, R. 2009. „Srbija – Kreativne industrije i kreativna ekonomija – mogućnosti i teškoće". U: Đerić, A. (ur.) *Mad Marx – Kreativan kapital Srbije, knj. 1, Kreativne industrije i ekonomija znanja*. Beograd: Academica – Akademska grupa.

Spennemann, D. 2021. "Residential architecture in a post-pandemic world: Implications of COVID-19 for new construction and for adapting heritage buildings". J*ournal of Green Building* 16(1): 199–215. https://doi.org/10.3992/jgb.16.1.199 (assessed: 12. 9. 2022).

Other sources

Eurostat 2021. European Statistical System (ESS) – European Statistical System (ESS) – Eurostat (Europe.eu).

UNCTAD 2022. Creative Economy Outlook 2022 (retrieved from: unctad.org on 22. 10. 2022).

UNCTAD 2022a. Development prospects in a fractured world: Global disorder and regional responses, available at Trade and Development Report 2022 | UNCTAD.

World Bank Report 2017. Under the Results Based Management Reimbursable Advisory Services Agreement (P163203).

World Bank 2017. Republic of Serbia Creative industries: Policy Note, December 2017.

WTO 2020. WTO Annual Report 2020, available at WTO | Publications – WTO Annual Report 2020.

EKOSISTEM INOVACIJA IT SOFTVERA ZA RAZVOJ KKI – SLUČAJ SRBIJE

Sažetak. *Sektor IT i softverske aktivnosti u okviru njega, zahvaljujući svojim inovacijama postale su neizostavan deo novih i nadolazećih tehnologija, koje suštinski menjaju druge kulturne i kreativne industrije (KKI). Za potrebe ovog rada autori su sproveli 2022. godine empirijsko istraživanje nacionalnog softverskog inovacionog ekosistema u koje su bile uključene 242 IT kompanije iz cele Srbije. Za procenu uticaja tri grupe faktora inovacionog ekosistema – institucionalnih, poslovnih i internih, korišćene su multiregresiona analiza i Likertova skala. Ključni rezultati istraživanja*

pokazuju uticaj svih faktora, ali najveći uticaj na obim, kvalitet i vrstu softverskih inovacija imaju institucionalni faktori, javna politika i mere institucija. Rezultati ovog rada mogli bi da doprinesu kreiranju politika zasnovanih na inovacijama u okruženju koje promoviše kreativnu IT ekonomiju u Srbiji.

Ključne reči: *kreativne i kulturne industrije, IT softver, inovacije, ekosistem podrške*